UK Hydrological Bulletin: February – April 2012

The synoptic patterns that resulted in exceptional rainfall deficiencies across much of western Europe were maintained through the late winter and early spring. Correspondingly, the UK drought intensified and extended its spatial extent but is still focused on the English Lowlands where the margin between rainfall and evaporation losses is narrow and concentrations of population, intensive agriculture and commercial activity create high water demand. An exceptionally wet April moderated agricultural drought stress but had only a limited impact on seasonally very depressed groundwater resources.

After a wet start, storm frequency declined markedly through the winter as persistent high pressure diverted most Atlantic frontal systems to the north of the country. Although snowfall extended down to the South East on the 4th February, the month as a whole was mild and dry with long sequences of days when precipitation was restricted to fog-drip. Winter (Dec–Feb) rainfall totals were below 70% of average across parts of eastern and southern Britain and through the UK's driest March since 1953 rainfall deficiencies in the drought-affected regions reached an exceptional magnitude. The 2011/12 winter was the sixth successive season to register below average rainfall in parts of central England and, crucially from a water resources perspective, England registered its 2nd lowest rainfall for successive winter half-years (Oct–Mar) in a series from 1910 (see Figure 1). Rainfall deficiencies can be traced back to the winter of 2009/10 and, whilst several similar or drier 'two–year' droughts have occurred (e.g. 1995–7, 1990–2, 1932–34, 1920–22), the hydrological severity of the current drought strongly reflects the disproportionate concentration of the current rainfall deficiency in the autumn-to-spring timeframe.

Runoff rates which were seasonally depressed through the late autumn of 2011 across much of southern Britain, increased during December but the seasonal recovery stalled, and sustained recessions characterised many rivers through the early months of 2012. Rivers registering new late-March minimum flows showed a very wide distribution (from the Scottish Dee to the Medway in Kent, and the Camowen in Northern Ireland). A few rivers including (e.g. the Tone in Somerset and the Dorset Stour) reported March runoff totals lower than those recorded during the extreme drought of 1976. The drought's severity in the worst-affected regions is best captured by medium-term runoff accumulations: for the winter half-year (Oct–Mar), runoff from the English Lowlands is the 2nd lowest (after 1976) in a series from 1961 and unprecedented in the April-March timeframe. Across much of the country March river flow patterns were more typical of the late summer and imply a contraction in the stream network comparable to any experienced in the last 50 years (for the early spring). The continuing failure of springs, the loss (albeit temporary) of aquatic habitat, low oxygen levels, limited effluent dilution, wetland dessication, and the appearance of algal blooms have underlined the environmental and ecological stress that is a defining characteristic of the current drought.

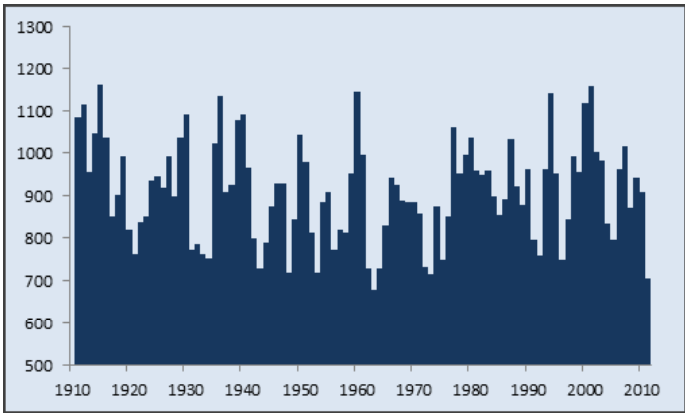

Fig 1 *Two-year winter half-year rainfall totals for England Data source: Met Office, National Climate Information Centre*

The regional focus of the drought in water resources terms is underlined by the early spring reservoir stocks and groundwater levels in the major aquifers. For England & Wales the decline in reservoir stocks through March was the largest since 1993 but, entering April, stocks remained within 10% stocks of the average for the time of year throughout most of northern Britain, Wales and Northern Ireland. By contrast, stocks in some reservoirs in southern and eastern England (including Bewl, Ardingly and Rutland) were at their lowest for early April. The drought's impact is even more compelling in groundwater terms. The meagre flows in baseflow-dominated streams and rivers is a direct reflection of the historically depressed groundwater levels across many major aquifer outcrop areas.

Generally the seasonal recovery in groundwater resources through the winter was extremely weak; this is particularly true of the Chalk. Figure 2 shows groundwater levels for the Stonor Park well in the Chilterns; only a modest rise occurred through the 2010/11 recharge season and there is no evidence of a recovery through the winter of 2011/12 — the well was dry by February. Based on a network of Chalk index

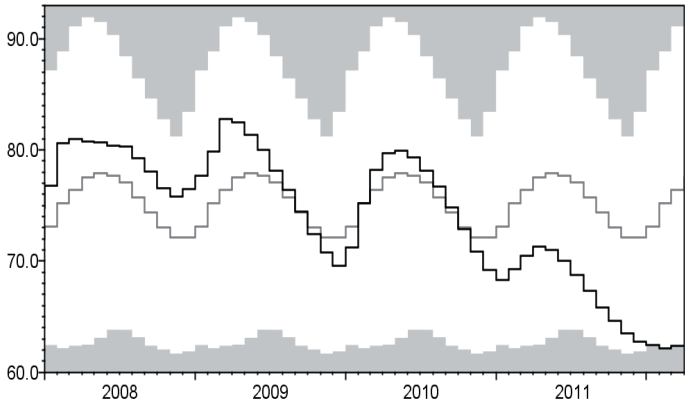

Fig 2 *Groundwater levels in the Chalk at Stonor Park*
Data source: Environment Agency

wells and boreholes with long records, overall storage in the Chalk for March was lower than in 1976 and, in a series from 1951, only 1992 has registered modestly lower overall aquifer storage (see Figure 3).

Throughout the spring latter stages of the drought a mix of measures has been deployed to moderate the drought's impact (e.g. additional water transfers, augmentation of low flows, fish rescues and public appeal to moderate water usage). In early April these were supplemented by hosepipe bans affecting around 20 million consumers in eastern, central and southern England. This closely coincided with a decisive change in synoptic patterns, bringing much cooler and much wetter conditions across the UK. Provisional data indicate that, although spatially very variable, April rainfall totals across much of the drought-affected regions exceeded the April average by 80% or more. Locally intense downpours were common and runoff rates increased smartly in responsive rivers; by the fourth week, flood alerts were widespread — embracing rivers from Cornwall to north-east Scotland.

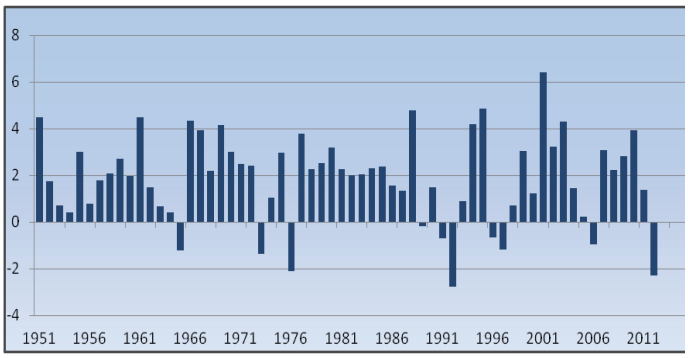

Fig 3 *An index of overall storage in the Chalk for March*

The April rainfall was particularly beneficial for farmers and growers but with late-March soil moisture deficits the highest on record for the UK, and the onset of the growing season boosting evaporative losses, it had only a moderate impact on the water resources and environmental dimensions of the drought. In the absence of further exceptional late spring and early summer rainfall across the drought-afflicted regions, rivers flows — particularly in permeable catchments — will decline further and groundwater level recessions will continue. Natural base levels have been reached or closely approached, remarkably early in the year, at a number of index wells and boreholes. At such sites little further decline in levels is anticipated but the possibility remains that, by the autumn, groundwater resources in some regions will have fallen to levels registered only five or six times in the last 100 years.

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